Technological Development

Technological Development Strategy | Technology-Driven Solutions and Innovation

The Osaka Gas Group aims to spur innovation for the next generation and provide optimal solutions to its customers by leveraging its accumulated core technologies.

Development of technologies for business solutions

- Accumulated data used to predict equipment failure and improve services
- Development of new carbon and chemical materials and the creation of new applications for those materials

Development of technologies to expand the use of natural gas

- Increased efficiency and decreased size of residential fuel cell ENE-FARM
- Built-to-order engineering using combustion technologies
- "Smart" gas appliances created using information communication technology (ICT)

Development of technologies in the environmental field

- Lowered price and improved efficiency of hydrogen generator HYSERVE
- Wastewater treatment systems developed
- Equipment developed to generate biogas from kitchen waste

Promotion of projects using engineering technologies

- Resource development and gas liquefaction engineering
- LNG facility engineering
- Power generation engineering

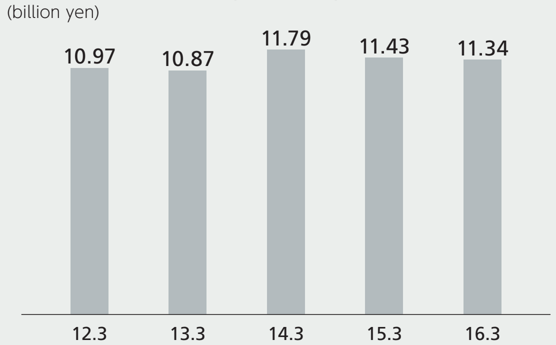
Priority Fields in Technological Development

Osaka Gas aims to improve its engineering capabilities in growth fields, including upstream business and the power generation business.

Looking ahead to the full deregulation of the retail electricity and gas markets, Osaka Gas is developing new gas appliances, such as fuel cells, to increase its competitiveness in gas appliance sales. Osaka Gas is also focusing its efforts on information communications technology (ICT) and big data analysis to provide new services that enhance value in the gas and electricity businesses.

Efforts are also being made to develop a wide range of materials and expand the material solutions business.

Research and Development Expenses (Consolidated)
(billion yen)



Development of Technologies for Business Solutions [Major Initiatives] —— Development of New Materials

Development of fluorene cellulose as a material to serve as a resin fiber (fiber for strengthening resin)

Fluorene, a coal-derived material, is processed by the Osaka Gas Group into fluorene derivatives that have excellent optical properties and heat resistance. Fluorene derivatives are used in liquid crystal displays, mobile phone camera lenses, and other devices.

Osaka Gas developed hydrophobized* fluorene cellulose by reacting the cellulose fiber surface with a fluorene derivative. Cellulose is a biomass material, and fiber made from cellulose (cellulose fiber) is one-fifth the weight of steel but has more than five times its strength. By mixing it with plastic, a strong, lightweight, heat-resistant plastic can be created for home appliances, automotive structural members, and other applications. It is a promising material with low environmental impact.

It will soon become possible to mass produce the material, further improve its performance, and lower its cost; its imminent commercialization is highly anticipated.


Fluorene cellulose

* Having a low affinity with water, meaning it does not mix well with water. Cellulose fiber is highly hydrophilic, so mixing it with plastics and other materials had previously been problematic.

Technological Development

Development of Technologies to Expand the Use of Natural Gas [Major Initiatives]—Development of the World's Highest Efficiency ENE-FARM

Development of the new ENE-FARM type S, the world's highest power generation efficiency in a compact structure

Osaka Gas, Aisin Seiki Co., Ltd., Kyocera Corporation, and Noritz Corporation jointly developed a new solid oxide fuel cell (SOFC) for residential use known as the ENE-FARM type S. This product achieves the world's highest*1 power generation efficiency (52%)*2 in the world's most compact structure.*3 Cost reductions were a achieved through major adjustments to the device specifications. In conjunction with the full deregulation of the retail electricity market we developed a new product and are purchasing (surplus) electricity generated from that new product but not used in customershomes. This helps customers reduce their utility costs as well as their CO_2 emissions.

*1 World's highest power generation efficiency using a household fuel cell with a ratedpower output of 1 kW or less (Source: Osaka Gas, as of February 24, 2016)
*2 Calculated using the lower heating value; LHV is a measure of the amount of heat that does not include the latent heat of vaporization of water vapor when fuel gas is completely combusted; the power generation efficiency for the LP gas model is 51%
*3 World's smallest solid oxide fuel cell (including waste heat management system) for residential use (Source: Osaka Gas, as of February 24, 2016)

Development of the New ENE-FARM type S—Improving Power Generation Efficiency Using the Osaka Gas Group's Technologies

Shin Iwata
Manager, SOFC micro-CHP Development Team
Residential Energy System Development Department

After developing the first residential fuel cell, ENE-FARM, in 2009, we continued to create new models and to pursue the goals of higher efficiency, smaller size, and reduced cost. The ENE-FARM type S uses a solid oxide fuel cell (SOFC) and although had been able to achieve a high power generation efficiency of 46.5%, as previously, we took on the challenge to improve the efficiency even further. By using Osaka Gas technologies to apply a coating to the cell stack, where electricity is generated, we were able to improve power generation efficiency, reaching a high efficiency of 52%, while also improving heat resistance.

By thus increasing the power generation efficiency, we were able to reduce waste heat and eliminate the need for a large hot water tank. Thus, we were able to mount a small tank in the power generating unit, allowing us to achieve a single unit appliance. In addition, by improving the system so that an existing gas water heater could be used as a supplemental heat source, we were able to achieve the world's smallest appliance of its kind. These developments meant that the system could be installed not only in detached residences, but also in apartment buildings with only limited space. In addition, great efforts have been made to even further reduce costs by using the Osaka Gas Group's low cost catalyst as a component of the fuel cell. By increasing environmental functionality as well as economy, we are further encouraging uptake of this appliance amongst a greater number of customers.

ENE-FARM is an amalgamation of many different technologies. By combining the technologies possessed by the joint developers Aisin Seiki Co., Ltd., Kyocera Corporation, and Noritz Corporation, with the Osaka Gas Group's technologies and know-how in cogeneration system development and maintenance, as well as catalysts, we were able to achieve a high level of functionality unmatched by our competitors.

With SOFC, it should theoretically be possible to increase power generation efficiency up to as high as 80%. There is also great potential for the achievement of even further size and cost reductions. We will continue to pursue higher efficiency, smaller size, and reduced costs in the future.

Development of Technologies to Expand the Use of Natural Gas [Major Initiatives]—Industrial Furnace Simulation Technologies

Industrial furnace simulation technologies

Osaka Gas develops gas burners used in equipment designed for various purposes, including heat treatment, drying, and liquid heating. We meet our customers' diverse needs for reduced initial costs, high efficiency, and energy conservation. Industrial furnace simulation technologies support the high efficiency, low environmental impact design and operation of various types of heating furnaces, melting furnaces, and heat treating furnaces.

Using supercomputers, we can predict the temperature increases of heated objects and offer energy-saving simulations that propose higher efficiency methods of operation to customers. By performing simulations to optimize nozzle structures and waste heat collection mechanisms in the development of new burners, we support burner development in a way that results in both high-functionality burners and a shortened development process timeline. We will continue to try to improve the reliability of our simulations, and will promote support for the engineering of industrial furnaces and the development of burners.

Experimental furnaces measure actual data

Development of Technologies in the Environmental Field [Major Initiatives]—Toward a Hydrogen Society

Clean energy hydrogen stations

The HYSERVE-300 system was developed by Osaka Gas to produce hydrogen from city gas. We installed this system at a commercial onsite hydrogen station that began operating in Ibaraki, Osaka in April 2015. In March 2016, we began operating a mobile hydrogen station in Minami-ku, Kyoto. We transport hydrogen manufactured at the Kita-Osaka Hydrogen Station and supply it to customers using the mobile hydrogen station.

Osaka Gas is striving to improve running efficiency of the Kita-Osaka Hydrogen Station and achieve more efficient operations by establishing a mother-and-daughter model that integrates the Kita-Osaka Hydrogen Station (mother station) and the Kamitoba Hydrogen Station (daughter station).

Osaka Gas is helping to build a low-carbon society by providing automakers with hydrogen fuel for fuel cell vehicles developed for the general public, and selling HYSERVE systems for hydrogen stations.

Kita-Osaka Hydrogen Station
(Began operation in Ibaraki, Osaka in April 2015)

Kamitoba Hydrogen Station
(Began operation in Minami-ku, Kyoto in March 2016)

Promotion of Projects Using Engineering Technologies [Major Initiatives]—Construction of a Large-Capacity PCLNG Tank

Completion of world's largest aboveground LNG tank using the latest technologies

The world's largest capacity aboveground tank, with a volume of 230,000 m³, was completed and went into operation at the Osaka Gas Senboku No. 1 Works in November 2015.

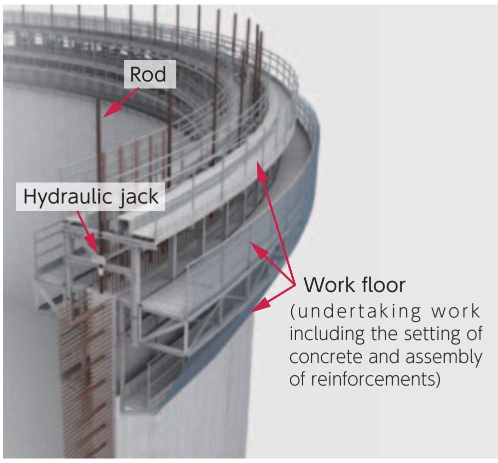
Cost reductions achieved with the development and use of 7% nickel steel, using less rare earth metal

This is the first time in the world where 7% nickel steel was used as the inner tank material. This reduces the cost of the inner tank materials while achieving the same performance as conventional 9% nickel steel.

Slipform construction method considerably shortens time to build outer tank

Osaka Gas built an outer tank using the slipform construction method, a first for a PCLNG tank in Japan. This construction method uses hydraulic jacks to raise integrated formwork and scaffolding equipment, allowing for the continuous placement of reinforcements and concrete without construction joints.

While the previous method required nine months for the construction of a PCLNG tank, this method takes just 20 days.



Visual representation of the slipform mechanism